



Grassland Birds at Fermi National Accelerator  
Laboratory: A Study of Bird Populations with Respect to  
Habitat, Temperature, Relative Humidity, Wind Pressure  
and Time of Day

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# Introduction

 Illinois is known as the “Prairie State.” However, very few healthy, functioning prairie ecosystems remain.

 In Illinois, less than .001 percent of the original native grasslands remain.

 Breeding Bird Survey (BBS) data from 1966-1993 indicate that almost 70% of the 29 grassland bird species adequately surveyed by the BBS have shown a negative population trend.

# Factors for the Decline

- ★ The factors that are responsible for the decline of grassland birds are not entirely known.
- ★ Three primary reasons for the decrease of grassland bird species are habitat loss, degradation of grassland area due to inadequate land management, and habitat fragmentation, which involves the division of large, adjacent areas of habitat into small, discontinuous plots of land.

# Why don't we create more habitats that birds prefer?

- ✦ Grassland birds prefer a wide range of grass heights and densities.
- ✦ Some prefer short vegetation while others prefer taller, more dense vegetation.
- ✦ Because of these differences, the responses of a particular species to a specific grassland management prescription will vary.

# Goals of This Study

- My aim is to determine if the presence of grassland birds, fluctuate between the various sites at Fermilab.
- The second focus of this study is to determine if bird presence is affected by the independent variables (time of day, temperature, wind speed, and relative humidity and the dependent variable (bird sightings).

# Where was I collecting data?

- ★ The sites indicated for observations are located in tracts which have been categorized by the ELM Committee's land management plan. They include ELM 1 (Betz prairie in the center of the Tevatron), ELM 28 (southwest corner of Eola Rd. and Batavia Rd.), ELM 25 (Interpretive Trail), ELM 10 (North Eola, near Eola and Batavia Rds.) ELM 4 (Main Injector) and ELM 9 (East side of A.E. Sea). The sites were selected because of their burnt history and stages of prairie restoration and location on Fermilab property.



## Fermilab Fire Management Areas

August 2001



# Pictures of Various Sites





# Materials

- Binoculars
- A journal to record bird sightings
- A copy of *Sibley's Handbook of Bird*
- Stop watch
- Flags to mark my pathway

# Methods

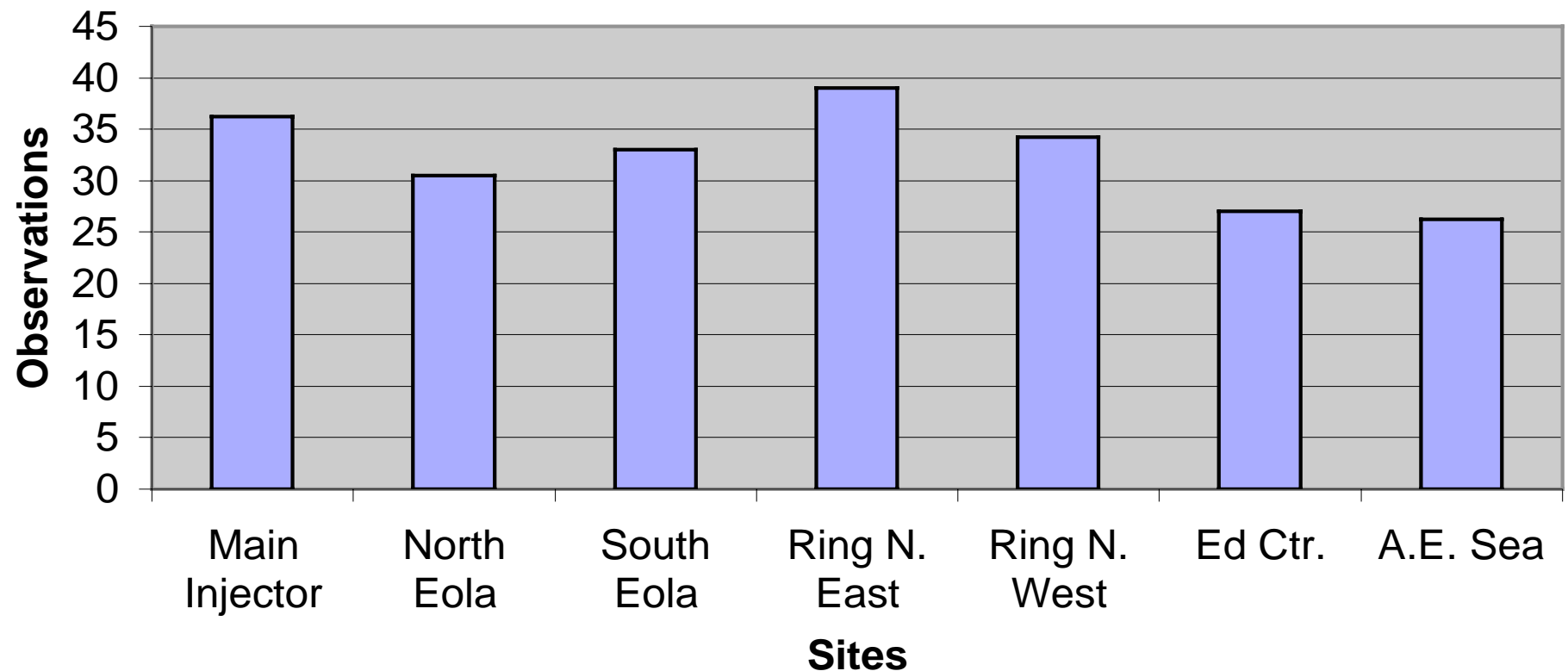
- ★ One -half hour was spent at each site recording data.
- ★ While at each site, observation notes were documented to estimate the presences of each grassland bird population.
- ★ Time was used as a measurement rather than distance; the time was equalized so that the effort was always held constant.
- ★ Therefore, Catch per Unit Effort is proportional to the effort expended in taking the sample.

# What did I do when I saw an unknown bird?

- ★ Whenever a bird was seen that I did not recognize, I tried to describe it in my notes as much as possible.
- ★ I would try to look it up in my handbook immediately after I completed observation of that particular site.
- ★ Birds are very predictable; I often went back to the same place so I could identify the mystery bird.

# Results and the Average Bird Count of All 7 sites

Observations from 7 Sites



# Journal of My Results

	M. Inject	N. Eola	S. Eola	Ring NE	Ring NW	Ed. Ctr.	A.E. Sea	
7:30- 9:30	49	33	35	41	36	25	34	36.14286
9:30- 11:30	29	40	42	48	31	37	20	35.28571
12:00- 2:00	51	24	26	42	35	22	19	31.28571
2:00- 4:00	16	25	29	25	35	24	32	26.57143
	36.25	30.5	33	39	34.25	27	26.25	



# What does all this mean?

- ★ These figures show that there is not a large variance with regards to the bird population amongst the various sites.
- ★ An ANOVA test was used to determine whether distribution among sites is significantly non-random at a  $< 0.05$  significance level.
- ★ The probability of this result assumes the null hypothesis is  $p = 0.43$ .

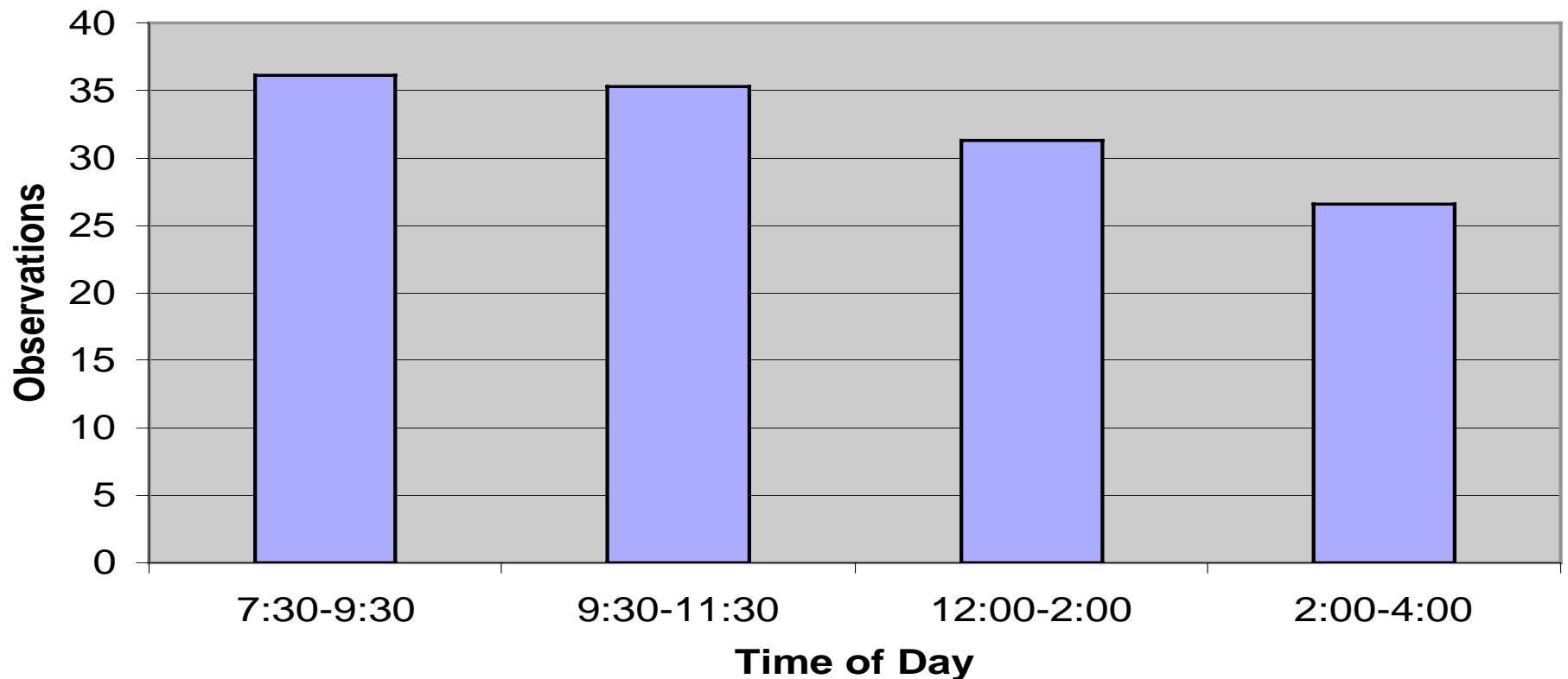
# Conclusion

- ★ There doesn't appear to be any evidence to support the claim that the areas are any different with respect to their use by birds.



# Does the time of day affect the presence of birds?

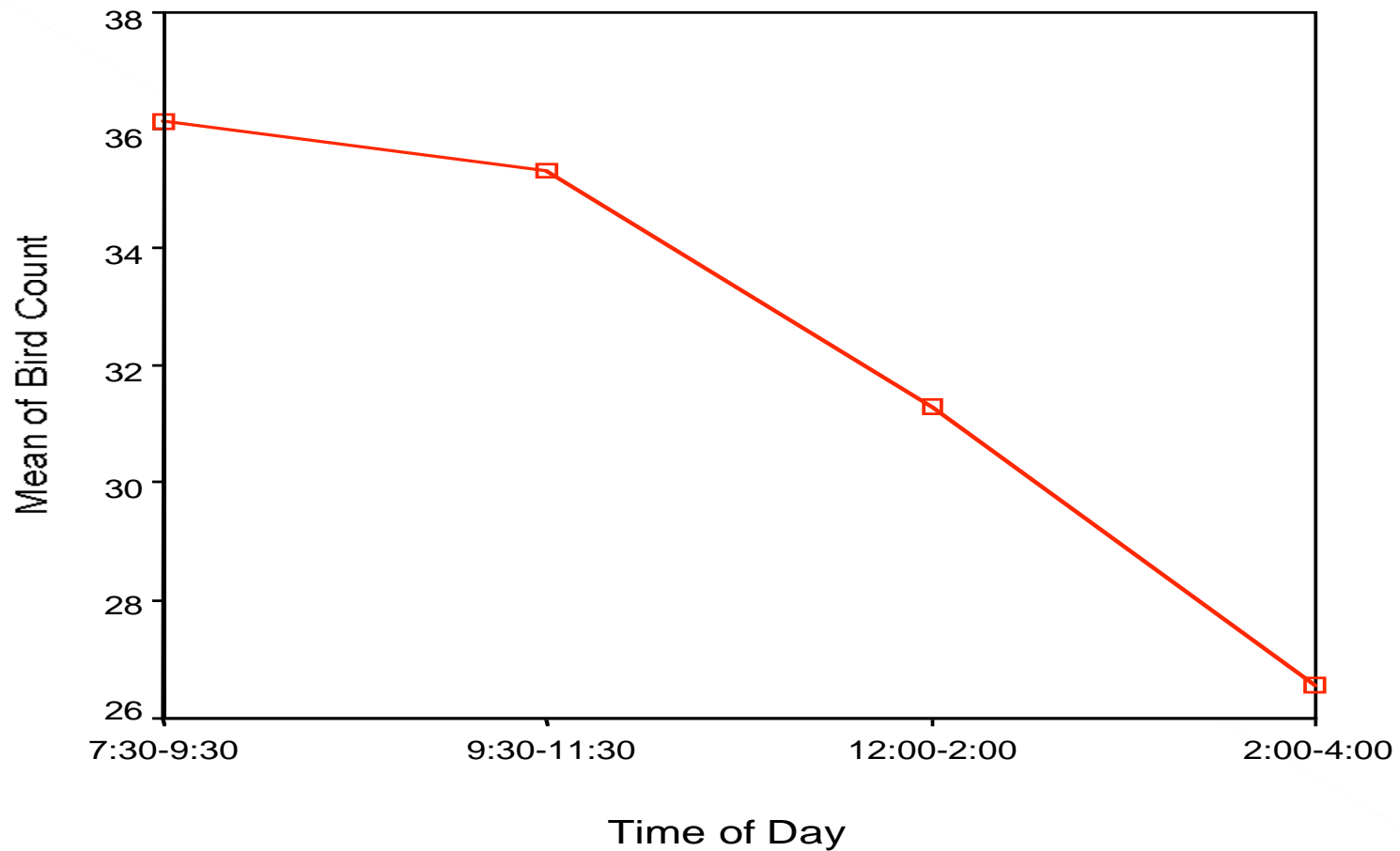
**Observations at Different Times**



# What does the data tell us?

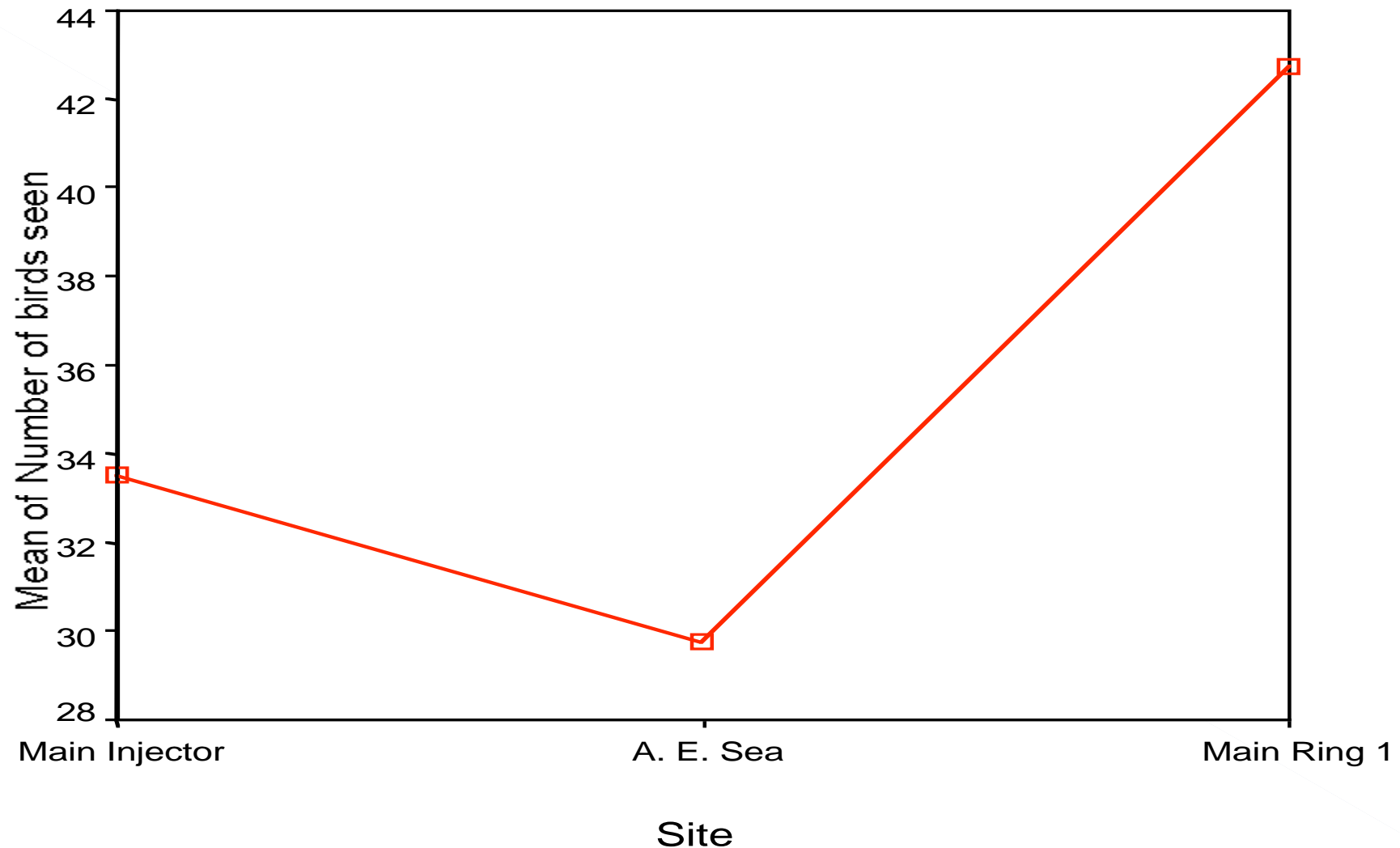
- ✦ A one-way analysis ANOVA on correlated samples comparing the times of day that the data were collected was done.
- ✦ The test was run under the assumption that the values were not independent, but were taken in that specific order for a reason.
- ✦ The result of this was not significant because  $p = 0.194$ .
- ✦ However, there is an evident trend toward fewer observations later in the day.

# A Trend with Time?





# A Closer Look at 3 Individual Sites



# What were the results of the 3 sites?

- ★ More observations at the three sites indicate possible differences among the sites.

# Results of all the sites

- ★ The results showed  $p = 0.063$ , which is borderline significant.
- ★ When looking at the multiple comparison table the correlation of the number of birds present between the Main Ring and A.E. Sea was  $p = 0.067$ . The number of birds present between the Education Center and the Main Ring was  $p = 0.072$  which is borderline significant.

# Does weather affect bird presences?

## Analysis of Variance Table for Multiple Regression Model:

Source	DF	SS	MS	F-stat	P-value
Model	3	652.2968	217.43227	3.3110712	0.038
Error	23	1510.3699	65.66825		
Total	26	2162.6667			

# What does this all mean?

- ★ There is a statistically significant relationship between the independent variables (temperature, humidity and wind) and the dependent variable (bird sightings).
- ★ The independent variables were removed to symbolize non-significant factors affecting the dependent variable, birds counts. The first variable removed was wind speed; the next variable removed was temperature. The significance level got better as the variables were removed ( $P=0.016$ ).



# More weather conclusions

- ★ In all the tests that were run, this was the only one that had statistically significant relationship between the independent variables (temperature, humidity and wind) and the dependent variable, (bird sightings) ( $p=0.038$ ).
- ★ The R-squared value was .3016, which means that roughly 30% of the variability in the number of sightings can be explained by correlated changes in the three independent variables; however, 70% remains inexplicable.

# Data Table Showing Results

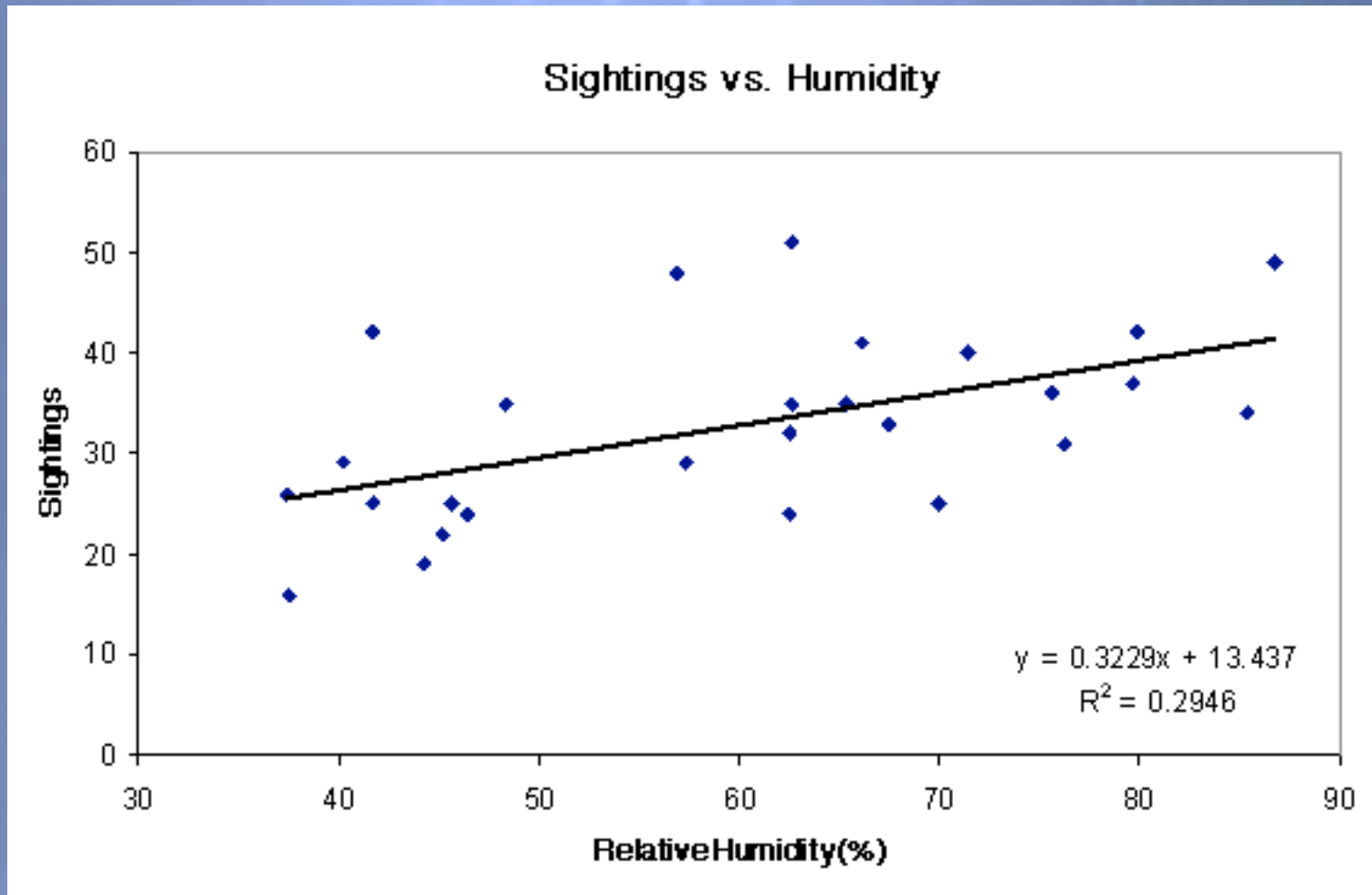
**Parameter estimates:**

<b>Variable</b>	<b>Estimate</b>	<b>Std. Err.</b>	<b><i>t</i>-statistic</b>	<b><i>p</i>-value</b>
Intercept	11.3	23.7	0.475	0.639
Temperature	0.0376	0.260	0.145	0.886
Humidity	0.343	0.128	2.67	0.0137
Wind	-0.204	0.425	-0.480	0.636

# Humidity Conclusions

- ★ The  $p$ -values in the parameter table tell us that only one of the three independent variables (humidity) is, by itself, a very good predictor of the number of sightings, because its  $p$ -value is the only one that is less than .05.
- ★ 29% of the variability in sightings can be explained by humidity. The other variables only add 1% of the number of sightings.

# Humidity Chart



# Does burning affect bird presence?



# Categorizing Burn History

- ❖ The sites visited were placed into two categories.
- ❖ The first data table consists of sites that were that were recently burned. They include the Main Injector, the Education Center trail and the Rig, which were burned between spring 2003 and 2004.
- ❖ The second set of area burned consists of North Eola South Eola, and A.E. Sea.
- ❖ The result of this test was a  $p$  value of 0.2, which was not significant value.
- ❖ There is no evidence to suggest that burning has anything to do with the visitation of birds to specific areas.



# New Questions That Have Arisen

- ★ There is some evidence to support the claim that birds are more active earlier in the day, because the means decreased at later time. Will this pattern emerge if the observer goes out earlier in the day, and stay later?
- ★ Further studies can be conducted to see how humidity affects birds, and whether this correlation implies implication.

# More Questions

- ✦ If I go outside when it's really humid, am I going to see more birds than when it's not so humid?
- ✦ Do birds prefer burned sites versus unburned sites?
- ✦ What if I collected data on a site that had not been burned in a few years, and then collected data after it had been burned? What affect would that have?

# Acknowledgments

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# More Acknowledgments

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# THE END

